US010969066B1

(12) **United States Patent**
Ormsbee et al.

(10) **Patent No.: US 10,969,066 B1**
(45) **Date of Patent: Apr. 6, 2021**

(54) **SYSTEMS AND METHODS FOR AN EFFICIENT, RECHARGEABLE GLOWSTICK**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/685,784**

(22) Filed: **Nov. 15, 2019**

(51) **Int. Cl.**

F21L 4/08	(2006.01)
F21K 2/08	(2006.01)
F21V 21/088	(2006.01)
F21L 14/02	(2006.01)
F21Y 103/00	(2016.01)
F21V 23/00	(2015.01)

(52) **U.S. Cl.**
CPC ***F21L 4/08*** (2013.01); ***F21K 2/08*** (2013.01); ***F21L 14/026*** (2013.01); ***F21V 21/0885*** (2013.01); *F21V 23/005* (2013.01); *F21Y 2103/00* (2013.01)

(58) **Field of Classification Search**
CPC .. F21K 2/08; F21L 14/026; F21L 4/08; F21V 21/0885; F21V 33/0004; F21V 33/008; F21V 23/004; F21V 23/005; F21Y 2103/00
See application file for complete search history.

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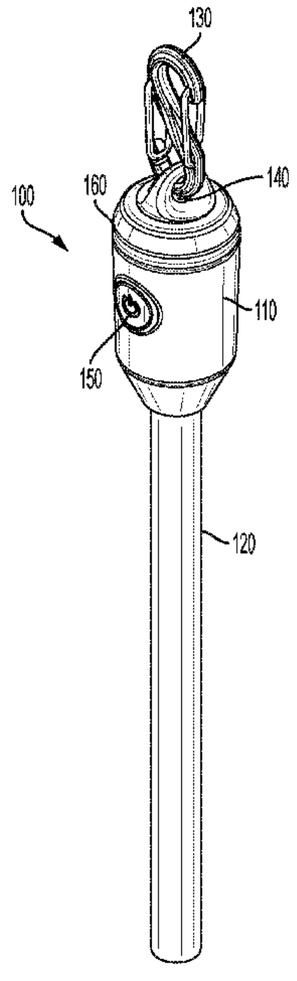
(57) **ABSTRACT**

A glowstick includes a lighting module, the lighting module including a light source having a primary direction of emission. The glowstick further includes a polymer rod, the polymer rod interfaced with the lighting module, the polymer rod having a length, a depth, and a width, wherein the length is greater than the depth and the length is greater than the width, the polymer rod proximate to the light source such that the primary direction of emission of the light source is aligned with the length of the polymer rod.

19 Claims, 12 Drawing Sheets



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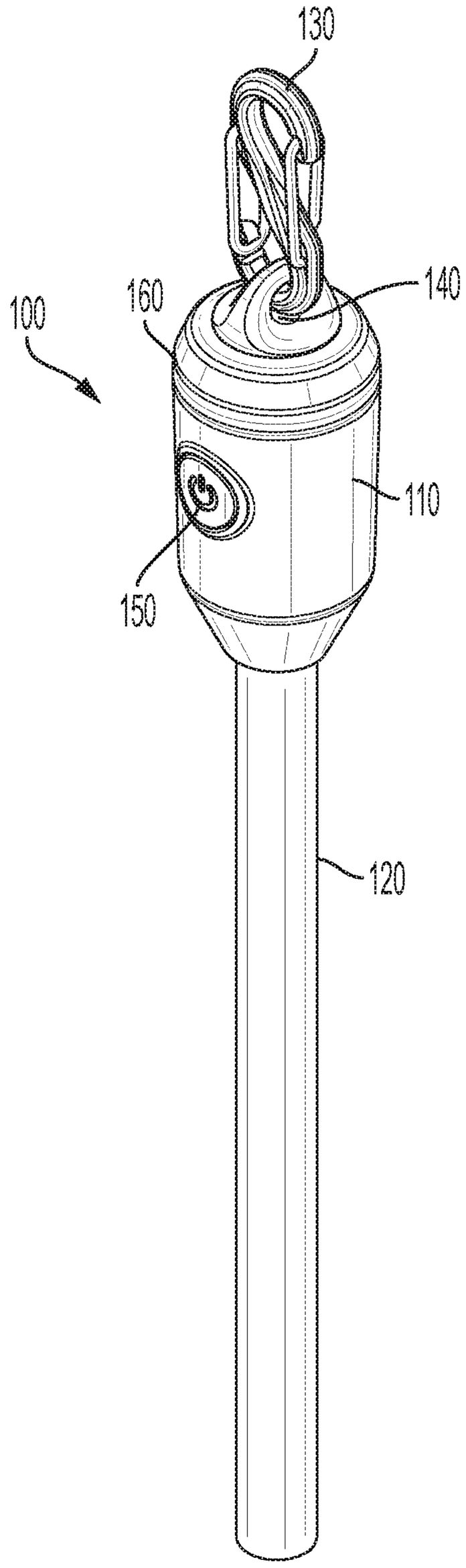

FIG. 1

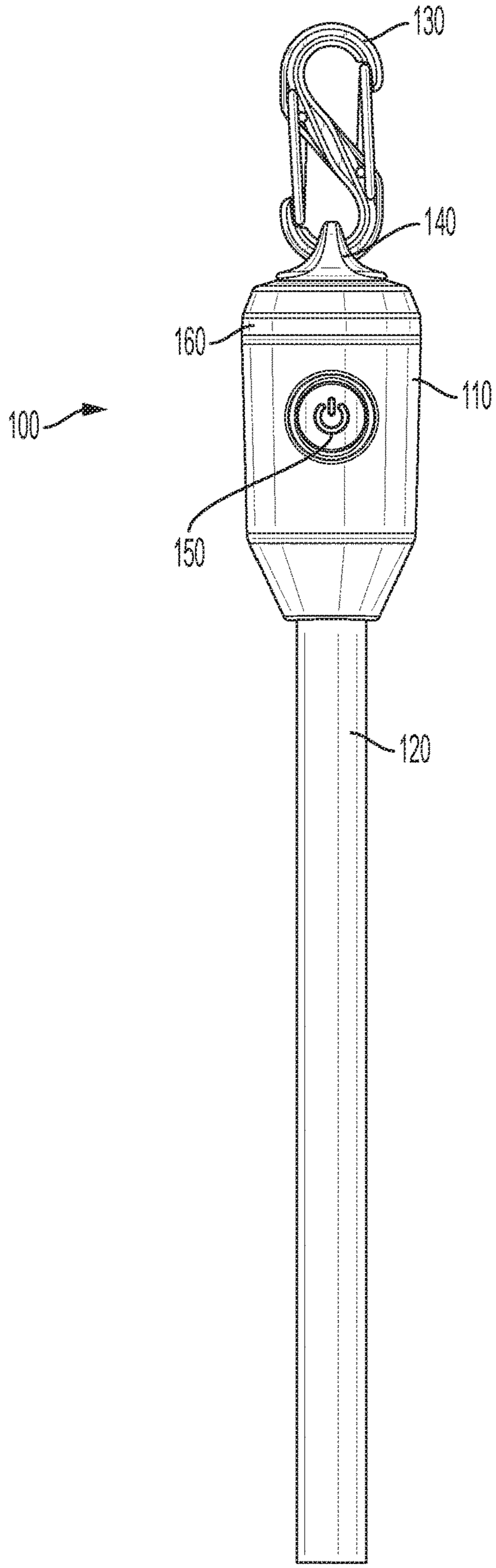

FIG. 2

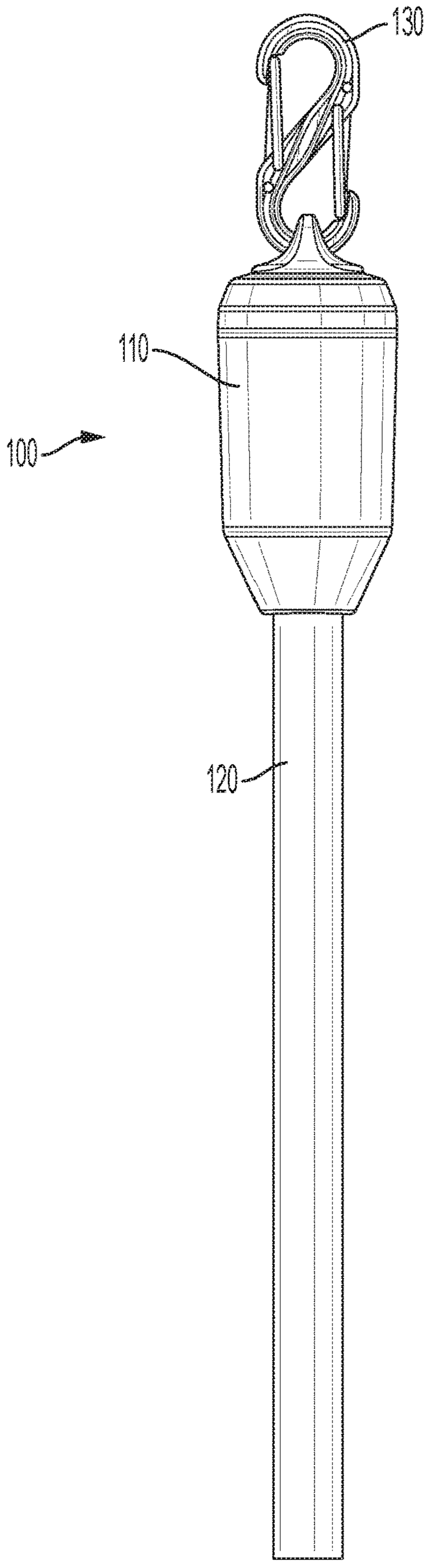

FIG. 3

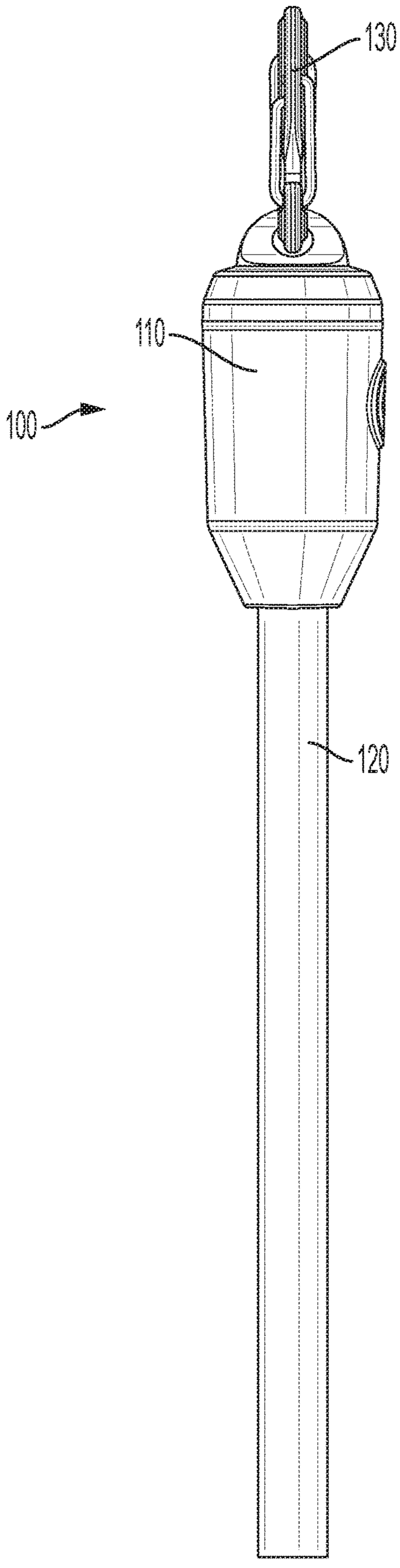

FIG. 4

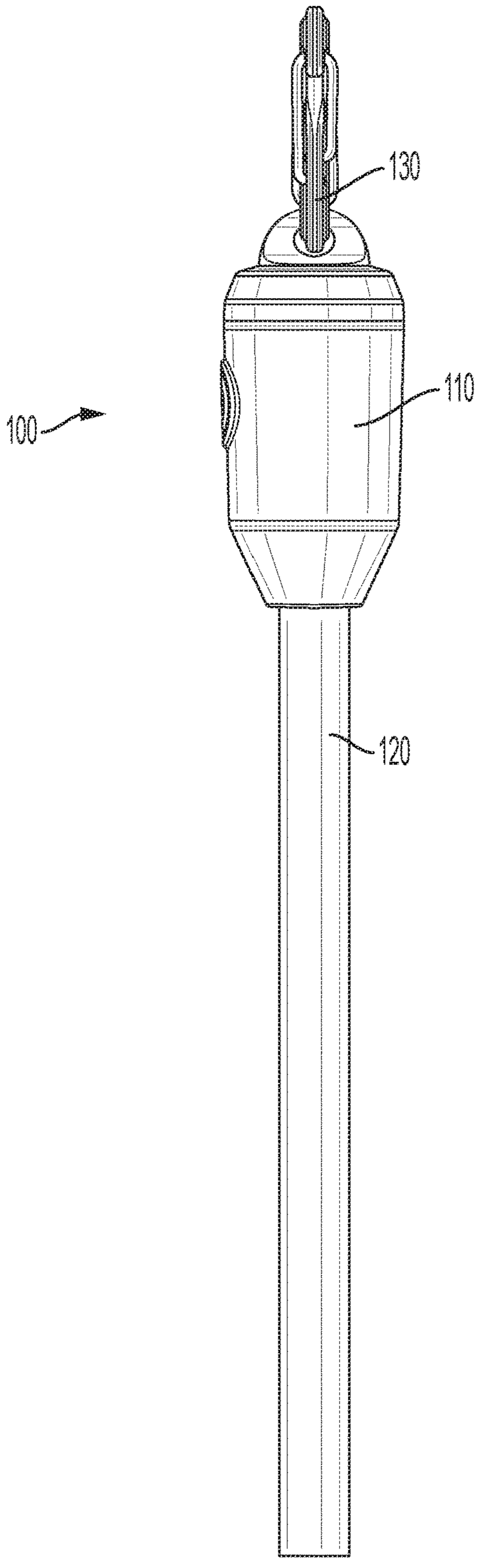

FIG. 5

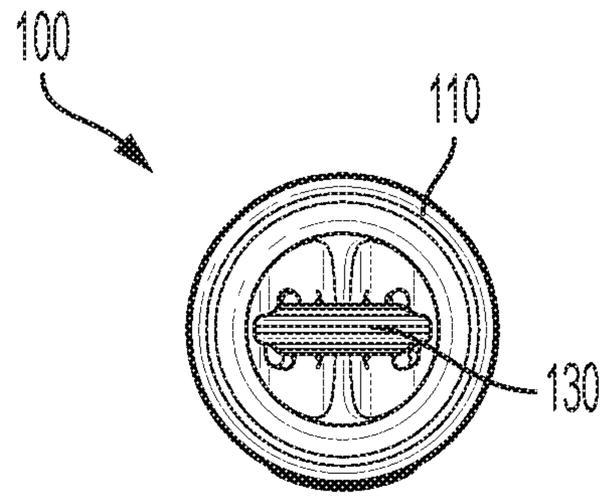

FIG. 6

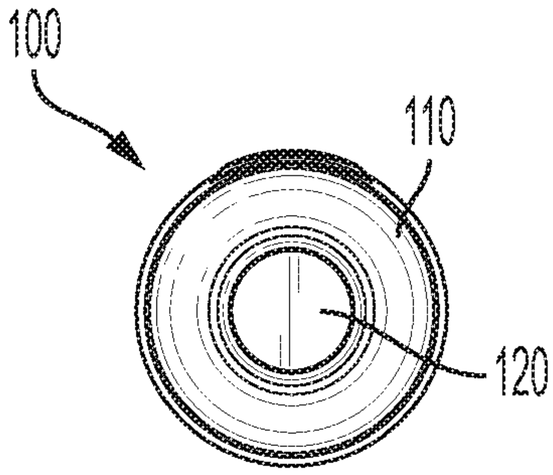

FIG. 7

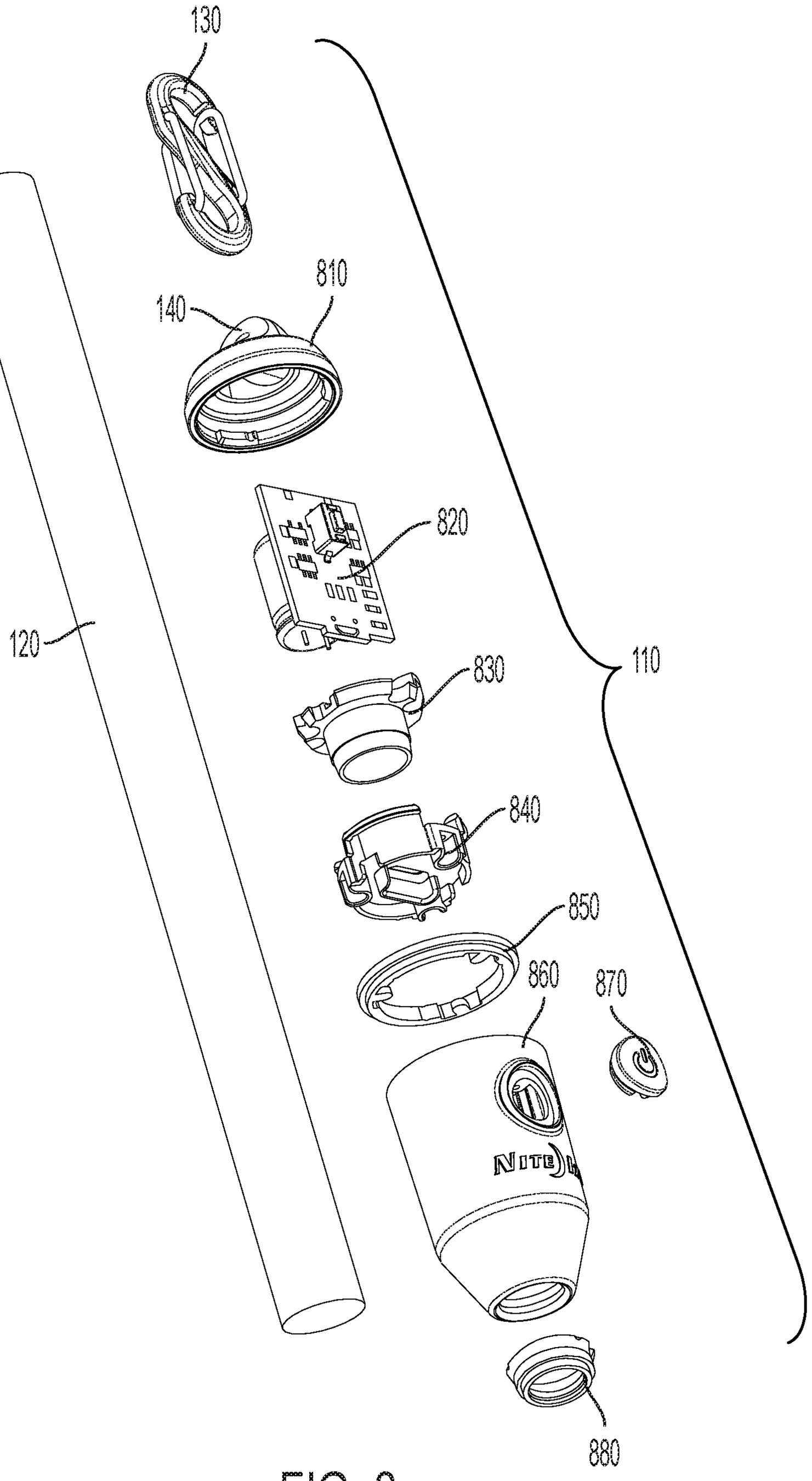

FIG. 8

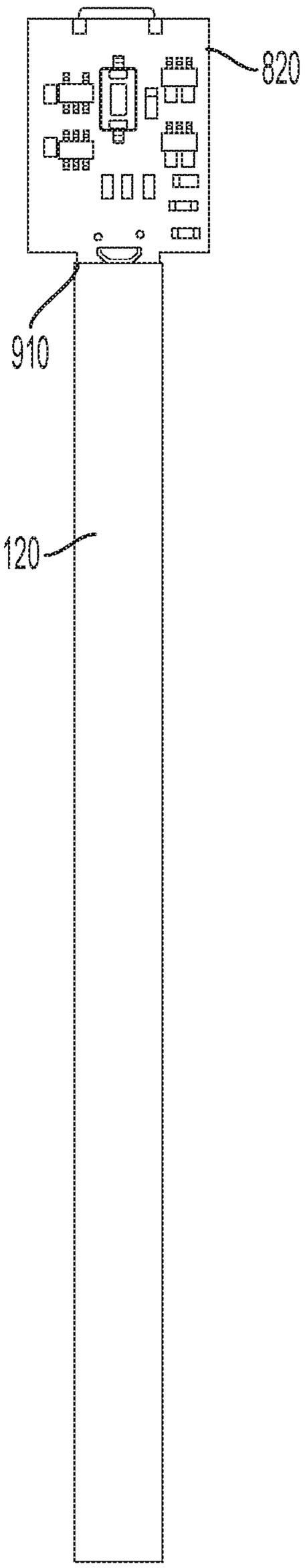

FIG. 9

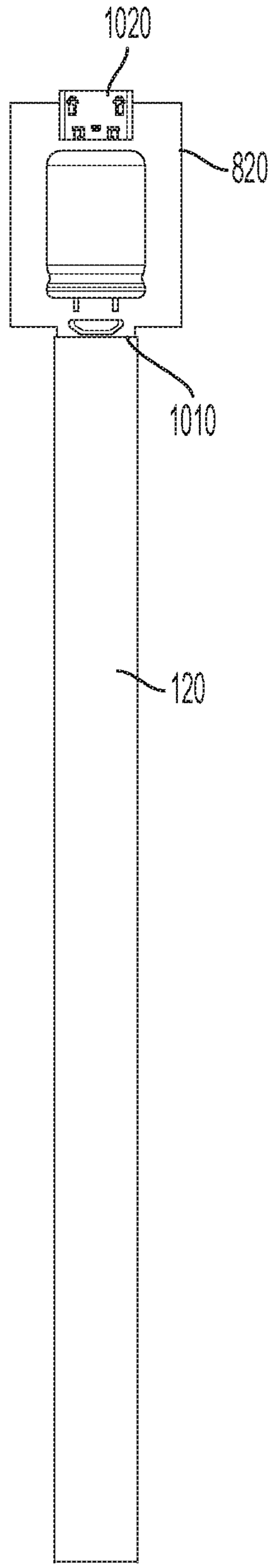

FIG. 10

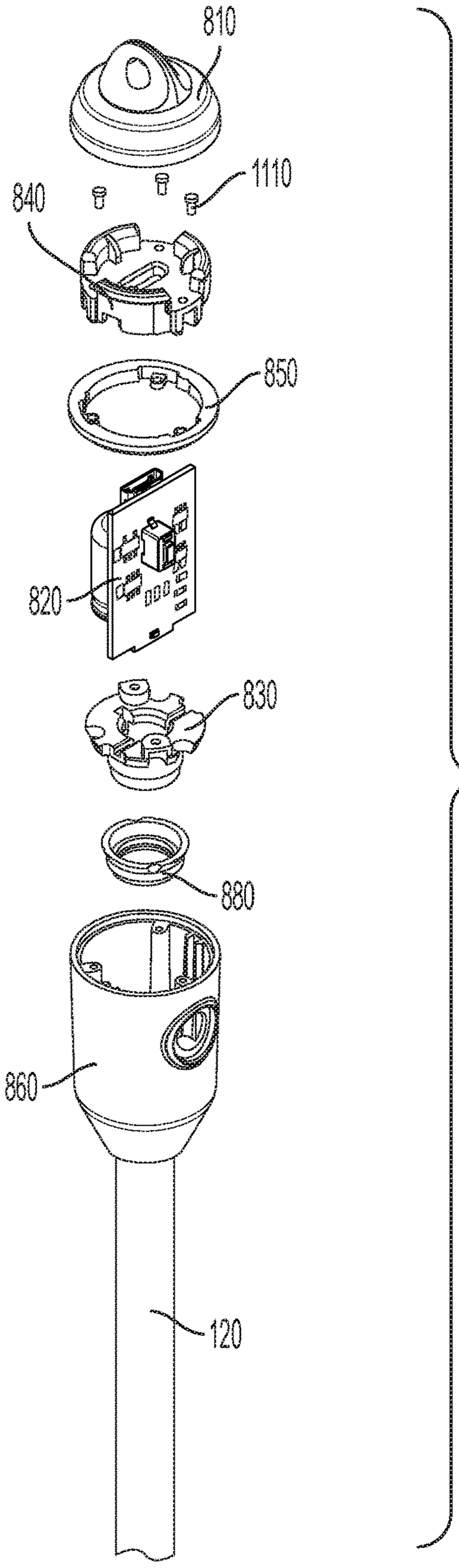

FIG. 11

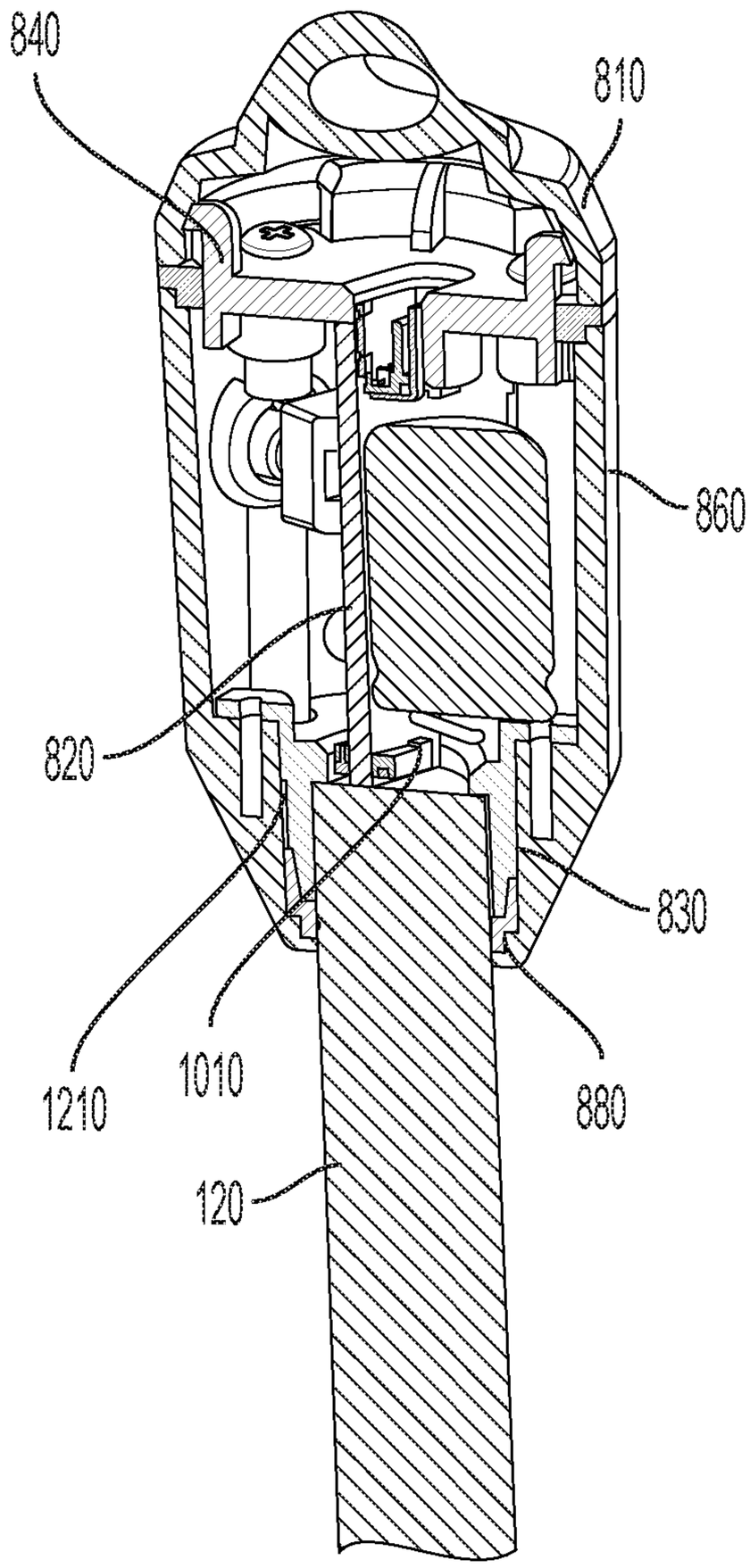

FIG. 12

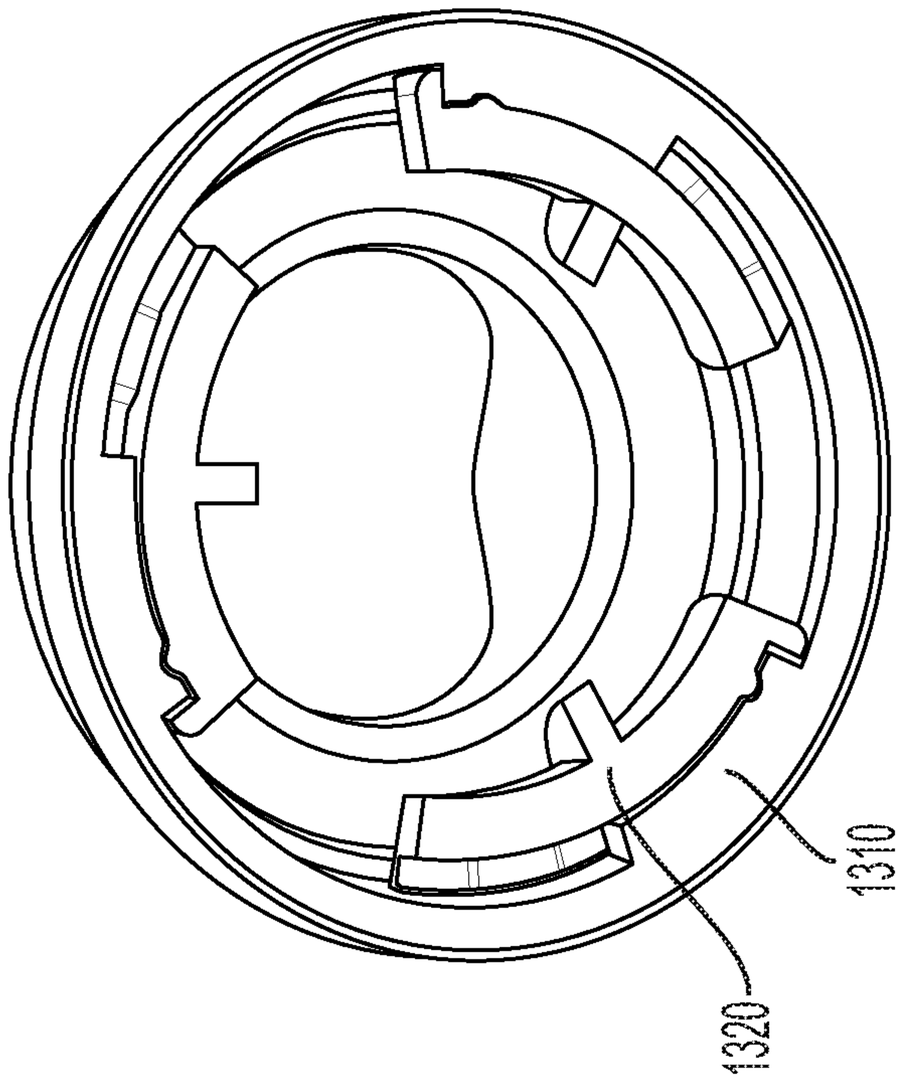

FIG. 14

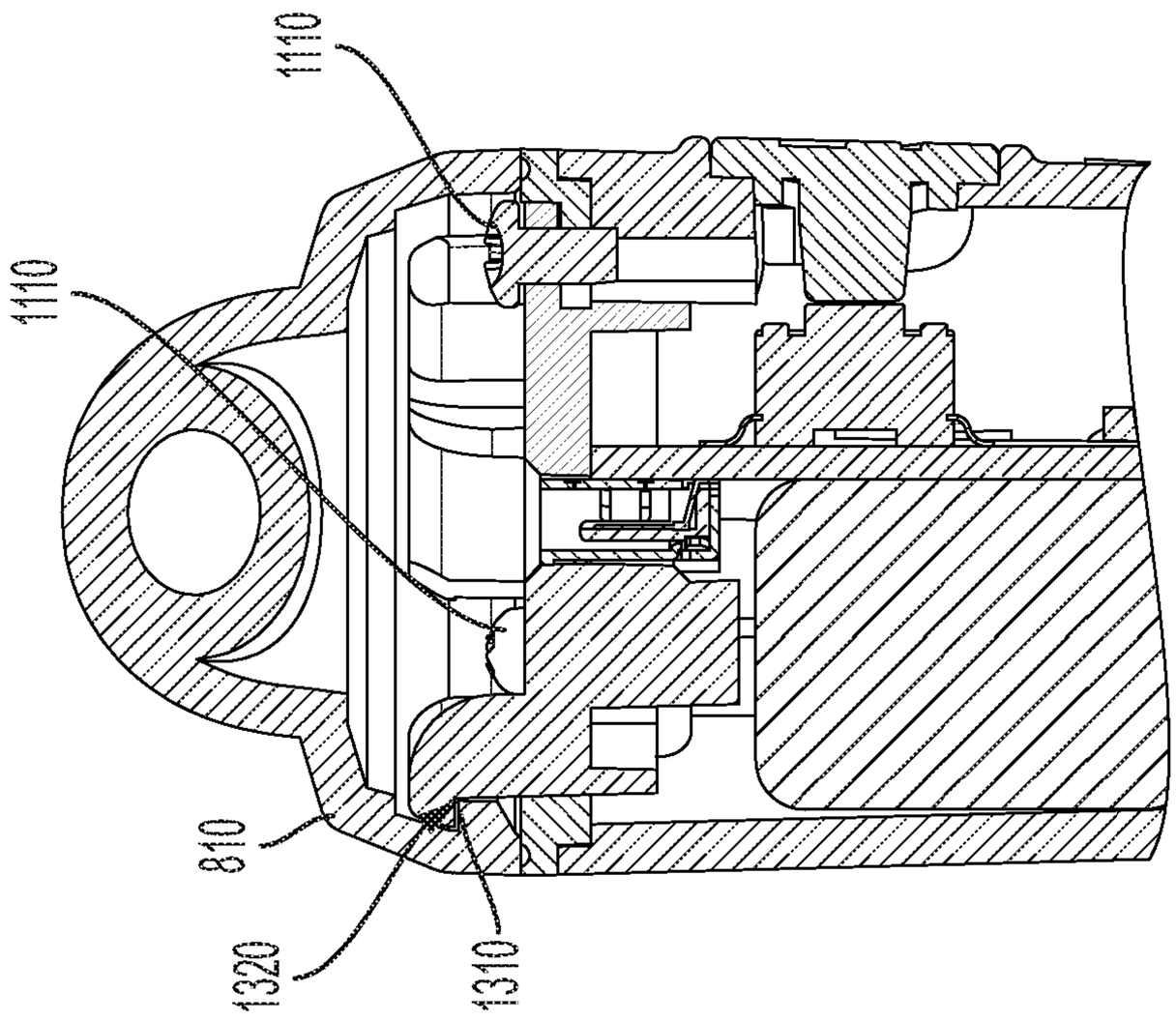

FIG. 13

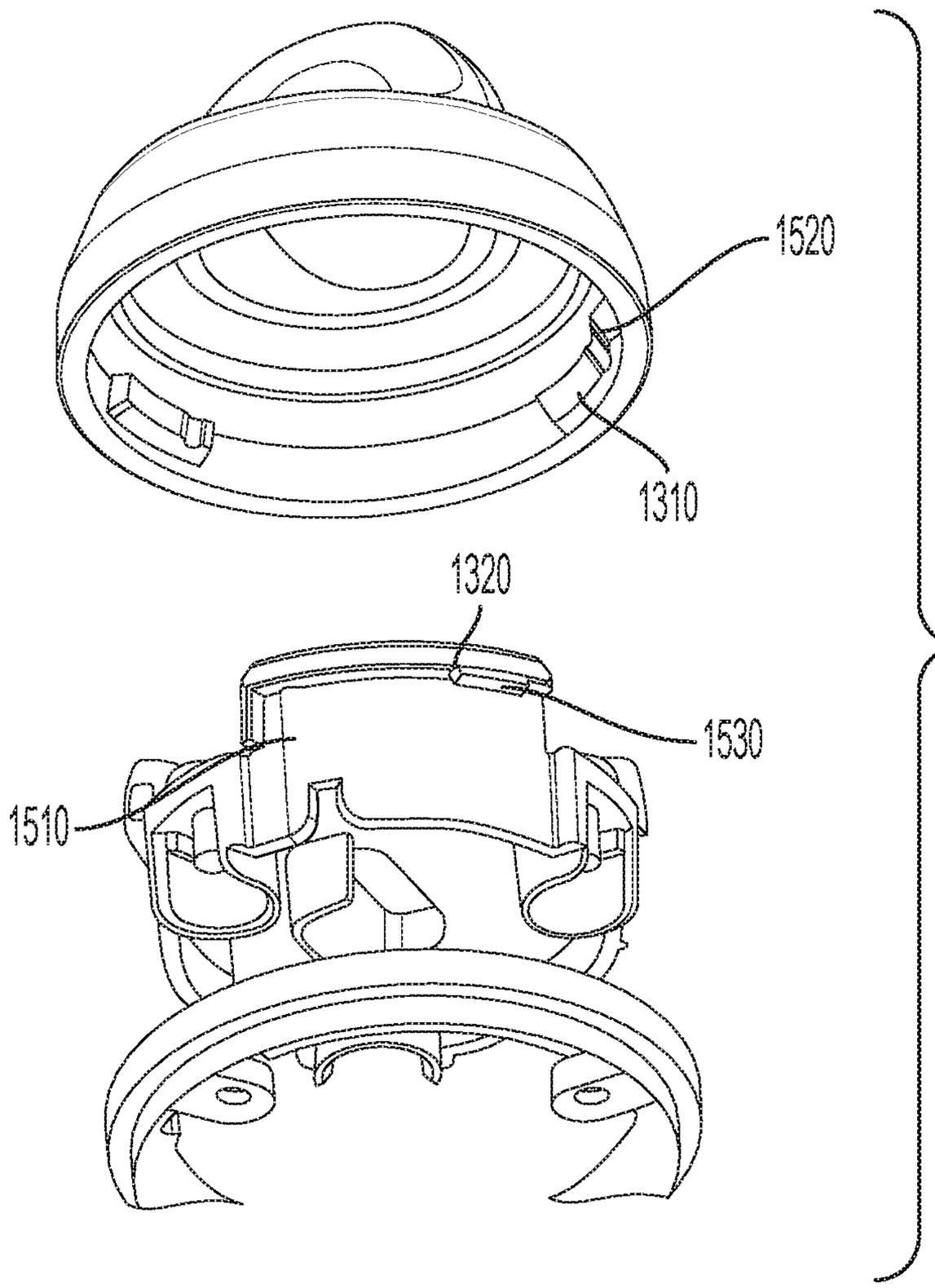

FIG. 15

SYSTEMS AND METHODS FOR AN EFFICIENT, RECHARGEABLE GLOWSTICK

BACKGROUND

Visibility is an important safety concern in many scenarios. Ordinarily it is not desirable to have a concentrated light source, since such light sources may be blinding in low light conditions. A single point source of light may not be large enough to be noticeable to parties at a lower level, so it is desirable to have a light defusing mechanism, in order to light a larger area at a lower light level.

BRIEF SUMMARY

In one embodiment, a glowstick includes a lighting module, the lighting module including a light source having a primary direction of emission. The glowstick further includes a polymer rod, the polymer rod interfaced with the lighting module, the polymer rod having a length, a depth, and a width, wherein the length is greater than the depth and the length is greater than the width, the polymer rod proximate to the light source such that the primary direction of emission of the light source is aligned with the length of the polymer rod. Alternatively, the lighting module has a body portion and the polymer rod extends into the body portion. In one alternative, the body portion includes an inner profile and the lighting module further includes a collet and a collar, the collet engaged with the inner profile, the collar, and the polymer rod such that the collet pushes the collar against the polymer rod and the inner profile, compressing the collar and holding the polymer rod in place. In another alternative, the polymer rod is held via an interference fit. Alternatively, the collar is between the polymer rod and the inner profile. In one alternative, the inner profile has a step profile being more narrow towards an end of the polymer rod distal from the lighting module and less narrow towards an end of the polymer rod proximate to the lighting module, and the collar, the collet, the polymer rod, and the inner profile cooperate to assist in holding the polymer rod in place at the end of the polymer rod proximate to the lighting module. In another alternative, the collet holds a circuit board, the circuit board including the light source, such that the light source is proximate to the polymer rod and the primary direction of emission is aligned with the length. Alternatively, a collet in the lighting module holds a circuit board, the circuit board including the light source, such that the light source is proximate to the polymer rod and the primary direction of emission is aligned with the length. In another alternative, the lighting module includes a lower body portion and a cap and an internal cap, wherein the internal cap is fixed in place and the cap interfaces with the internal cap to seal the cap to the lower body portion. Alternatively, the internal cap includes a lip and the cap includes a rib and the lip and the rib interface. In another alternative, the internal cap includes a rib along the lip and the cap include a detent, the detent interfacing with the rib when the cap is closed on the lower body. Alternatively, the internal cap includes a compression bump near the lip, the compression bump interfacing with the rib to provide positive resistance to rotation of the cap. In another alternative, a charge port is accessible under the cap through the internal cap.

In one embodiment, a glowstick includes a lighting module, including a light source, the light source having an emission direction. The glowstick further includes a light diffusion element, the light diffusion element having a length, a width, and a depth, the length greater than the width and the length greater than the depth, the emission direction aligned with the length, the lighting module interfaced with the light diffusion element. Alternatively, the light diffusion element is a polymer rod. In one alternative, the lighting module has a body portion and the polymer rod extends into the body portion. In another alternative, the body portion includes an inner profile and the lighting module further includes a collet and a collar, the collet engaged with the inner profile, the collar, and the polymer rod such that the collet pushes the collar against the polymer rod and the inner profile, compressing the collar and holding the polymer rod in place. Alternatively, the lighting module has a body portion and the body portion holds the light diffusion element using an interference fit. In another alternative, a collar is included in the lighting module and the body portion and the light diffusion element compress the collar in providing the interference fit. Alternatively, a charge port is accessible under a cap of the lighting module.

In one embodiment, a method of using a glowstick includes providing a glowstick. The glowstick includes a lighting module, including a light source, the light source having an emission direction. The glowstick further includes a light diffusion element, the light diffusion element having a length, a width, and a depth, the length greater than the width and the length greater than the depth, the emission direction aligned with the length, the lighting module interfaced with the light diffusion element. The light diffusion element is a polymer rod. The lighting module has a body portion and the polymer rod extends into the body portion, and the body portion includes an inner profile and the lighting module further includes a collet and a collar. The collet engaged with the inner profile, the collar, and the polymer rod such that the collet pushes the collar against the polymer rod and the inner profile, compressing the collar and holding the polymer rod in place. A charge port is accessible under a cap of the lighting module. The method further includes removing the cap and charging the lighting module. The method further includes replacing the cap and activating the light source.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows one embodiment of an enhanced glowstick;

FIG. **2** shows top view of the enhanced glowstick of FIG. **1**;

FIG. **3** shows a bottom view of the enhanced glowstick of FIG. **1**;

FIG. **4** shows a left side view of the enhanced glowstick of FIG. **1**;

FIG. **5** shows a right-side view of the enhanced glowstick of FIG. **1**;

FIG. **6** shows a front view of the enhanced glowstick of FIG. **1**;

FIG. **7** shows a rear view of the enhanced glowstick of FIG. **1**;

FIG. **8** shows an exploded view of the enhanced glowstick of FIG. **1**;

FIG. **9** shows one embodiment of a circuit board and polymer for use with embodiments of an enhanced glowstick;

FIG. **10** the bottom view of the circuit board and polymer of FIG. **9**;

FIG. **11** shows an exploded view of the enhanced glowstick of FIG. **1**;

FIG. **12** shows a cutaway view of the enhanced glowstick of FIG. **1**;

FIG. **13** shows a cutaway view of the enhanced glowstick of FIG. **1**;

FIG. **14** shows a cutaway view of the cap of enhanced glowstick of FIG. **1**; and

FIG. **15** shows a partial exploded view of the cap of the enhanced glowstick of FIG. **1**.

DETAILED DESCRIPTION

Certain terminology is used herein for convenience only and is not to be taken as a limitation on the embodiments of the systems and methods for an efficient, rechargeable glow stick. In the embodiments shown, the glowstick includes a uniquely oriented such that it abuts the light sources extremely closely. In many embodiments, it is desirable to have a light source that is in contact with or virtually in contact with the light source, in most cases an LED.

FIG. **1** shows one embodiment of an enhanced glowstick **100**. Glowstick **100** includes a lighting module **110**, a polymer stick portion **120**, and carabineer **130**. Polymer stick portion **120** is typically composed of transparent or translucent TPU (Thermoplastic polyurethane) or similar material. Lighting module **110** includes circuitry, light sources, and power sources that provide light to polymer stick portion **120**. Carabineer **130** provides for attachment of the device to various connectors such as coats, backpacks, etc. Lighting module **110** includes a switch **150** for controlling the function of the glowstick **100**. Carabineer **130** is connected to the lighting module **110** via eyelet **140**. The top portion of lighting module **110** may be unscrewed and removed at connection point **160**. FIG. **1** shows one embodiment of an enhanced glowstick. FIG. **2** shows a front view of glowstick **100**. FIG. **3** shows a rear view of glowstick **100**. FIG. **4** shows a left side view of glowstick **100**. FIG. **5** shows a right-side view of glowstick **100**. FIG. **6** shows a top view of glowstick **100**. FIG. **7** shows a bottom view of glowstick **100**.

FIG. **8** shows an exploded view of glowstick **100**. Visible are lighting module **110** exploded, carabineer **130**, and polymer stick portion **120**. Lighting module **110** is broken up into cap **810** which includes eyelet **140**, printed circuit board **820**, collet **830**, inner cap **840**, rubber gasket **850**, case **860**, silicone button **870** (may be made of other materials), and silicone ring **880**.

FIG. **9** shows the printed circuit board **820** and polymer stick portion **120**. As shown, the printed circuit board **820** includes a charge indicator light **910** that indicates when the device is charging. In FIG. **10**, the opposite side of the printed circuit board **820** is shown. Here, charging USB **1020** is show as well as an LED **1010**. Other charging ports are possible, like micro-USB, custom chargers, charge ports, or other ports. This this way the glowstick is rechargeable. Of course, the system includes a rechargeable battery in many configurations. In many embodiments, LED **1010** is a red/blue/green LED, such that multiple colors may be produced to light polymer stick portion **120**. In some alternatives, a white LED is also included.

FIG. **11** shows another exploded view of glowstick **100**. In this view the order of parts is essentially how the device is assembled. Polymer stick portion **120** fits into body **860** and is held in place via silicone ring **880** and collet **830**. Collet **830** wedges against silicone ring **880** and polymer stick portion **120** in order to provide a pressure fit arrangement. The collet **830** is shaped to hold the circuit board **820** as well, such that the light is held such that it abuts the polymer stick portion **120**. The inner cap **840** is oriented such that it holds the circuit board **820** in place in body **860**. The cap **810** is removably attached to the body **860** such that it may be removed to use USB **1020** for charging. Screws **1110** hold inner cap **840** in place.

FIG. **12** shows a cut away view of the glowstick **100**. Here it can be seen how collet **830** is designed to interface with silicone ring **880** and the inner body portion **1210** of body **860**. As shown, the inner body portion **1210** has a step like profile. At the lower portion of the step like profile, the void area is less than the thickness of the silicone ring **880** and the polymer stick portion **120**, such that when the collet **830** is screwed in the silicone ring **880** is compressed against the polymer stick portion **120** and the inner body portion **1210**. Additionally, the upper stepped portion has a slightly larger void area, such that it can accommodate and compress collet **830**, silicone ring **880**, and polymer stick portion **120**. As shown, LED **1010** is held tightly against polymer stick portion **120**. This figure also shows how the inner cap **840** interfaces with the cap **810**. This may also be referred to as an interference fit. Additionally, it is clear in this configuration that the LED **1010** is held in line with the length of the polymer stick portion **120**, such that the primary emission direction of LED **1010** is aligned with this length.

FIG. **13** shows additional view related to the cap **810**. The cap **810** interfaces with the inner cap **840**. Inner cap **840** includes a lip **1320** that holds against rib **1310** of cap **810**. The cutaway version in FIG. **14** shows the lip **1320** and the rib **1310** engaged in a locked fashion. As can be seen, when the lips are turned out of alignment the cap **810** will release.

FIG. **15** shows additional detail concerning the locking system. Cap **810** includes a detent **1520** that projects inward for locking. Inner cap **840** has a corresponding compression bump **1530**. Rib **1310** has a positive lock feel once the cap **810** is turned such that it passes compression bump **1530**. Detent **1520** eventually will turn and interface with rib **1510** and complete the lock. In this way the cap **810** maintains a smooth and consistent lock position compressing the rubber gasket **850**.

While specific embodiments have been described in detail in the foregoing detailed description, it will be appreciated by those skilled in the art that various modifications and alternatives to those details could be developed in light of the overall teachings of the disclosure and the broad inventive concepts thereof. It is understood, therefore, that the scope of this disclosure is not limited to the particular examples and implementations disclosed herein but is intended to cover modifications within the spirit and scope thereof as defined by the appended claims and any and all equivalents thereof.

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A glowstick, comprising:

a lighting module including a body portion, a circuit board and a light source disposed on the circuit board having a primary direction of emission;

a polymer rod interfaced with the lighting module, the polymer rod having a length, a depth, and a width, wherein the length is greater than the depth and the length is greater than the width, the polymer rod proximate to the light source such that the primary direction of emission of the light source is aligned with the length of the polymer rod;

an internal cap positioned within the body portion and holding the circuit board in place; and

a collet positioned within the body portion and holding the polymer rod and the circuit board in place, the circuit board interfaced with and positioned between the internal cap and the collet.

2. The glowstick of claim 1, wherein the polymer rod extends into the body portion.

3. The glowstick of claim 2, wherein the body portion includes an inner profile and the lighting module further includes a collar, the collet engaged with the inner profile, the collar, and the polymer rod such that the collet pushes the collar against the polymer rod and the inner profile, compressing the collar and holding the polymer rod in place.

4. The glow stick of claim 3, wherein the polymer rod is held via an interference fit.

5. The glowstick of claim 4, wherein the collar is between the polymer rod and the inner profile.

6. The glowstick of claim 5, wherein the inner profile has a step profile being more narrow towards an end of the polymer rod distal from the lighting module and less narrow towards an end of the polymer rod proximate to the lighting module, and the collar, the collet, the polymer rod, and the inner profile cooperate to assist in holding the polymer rod in place at the end of the polymer rod proximate to the lighting module.

7. The glowstick of claim 1, wherein the lighting module includes a lower body portion and a cap, wherein the internal cap is fixed in place and the cap interfaces with the internal cap to seal the cap to the lower body portion.

8. The glowstick of claim 7, wherein the internal cap includes a lip and the cap includes a rib and the lip and the rib interface.

9. The glowstick of claim 8, wherein the internal cap includes a rib along the lip and the cap include a detent, the detent interfacing with the rib when the cap is closed on the lower body.

10. The glowstick of claim 9, wherein the internal cap includes a compression bump near the lip, the compression bump interfacing with the rib to provide positive resistance to rotation of the cap.

11. The glowstick of claim 10, wherein a charge port is accessible under the cap through the internal cap.

12. A glowstick comprising:

a lighting module, including a body portion, a circuit board and a light source disposed on the circuit board, the light source having an emission direction;

a light diffusion element, the light diffusion element having a length, a width, and a depth, the length greater than the width and the length greater than the depth, the emission direction aligned with the length, the lighting module interfaced with the light diffusion element;

an inner cap positioned within the body portion and holding the circuit board in place; and

a collet positioned within the body portion and holding the light diffusion element and the circuit board in place, the circuit board interfaced with and positioned between the inner cap and the collet.

13. The glowstick of claim 12, wherein the light diffusion element is a polymer rod.

14. The glowstick of claim 13, wherein the polymer rod extends into the body portion.

15. The glowstick of claim 14, wherein the body portion includes an inner profile and the lighting module further includes a collar, the collet engaged with the inner profile, the collar, and the polymer rod such that the collet pushes the collar against the polymer rod and the inner profile, compressing the collar and holding the polymer rod in place.

16. The glowstick of claim 12, wherein the body portion holds the light diffusion element using an interference fit.

17. The glowstick of claim 16, wherein a collar is included in the lighting module and the body portion and the light diffusion element compress the collar in providing the interference fit.

18. The glowstick of claim 12, wherein a charge port is accessible under a cap of the lighting module.

19. A method of using a glowstick, the method comprising:

providing a glowstick, the glowstick including:

a lighting module, including a body portion, a circuit board and a light source disposed on the circuit board, the light source having an emission direction;

an inner cap positioned within the body portion and holding the circuit board in place; and

a light diffusion element, the light diffusion element having a length, a width, and a depth, the length greater than the width and the length greater than the depth, the emission direction aligned with the length, the lighting module interfaced with the light diffusion element, wherein the light diffusion element is a polymer rod extending at least partially into the body portion, and the body portion includes an inner profile and the lighting module further includes a collet and a collar, the collet positioned within the body portion and engaged with the inner profile, the collar, and the polymer rod such that the collet pushes the collar against the polymer rod and the inner profile, compressing the collar and holding the polymer rod in place, the collet holding the circuit board in place, the circuit board interfaced with and positioned between the inner cap and the collet, and a charge port is accessible under a cap of the lighting module;

removing the cap;

charging the lighting module;

replacing the cap; and

activating the light source.

* * * * *